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THESIS

ADOPTION OF THE INTERNET-BASED ELECTRONIC ORDERING SYSTEMS (EOS)- USERS' FACTOR ANALYSIS

by

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13. ABSTRACT *(maximum 200 words)*

Innovative technologies such as the Internet and World Wide Web are raising hopes of changing the picture of inefficient, complex and costly ordering processes and improving them in terms of quality, flexibility, and lead-time. The market of systems and services to support business-to-business relationships, in particular procurement processes, is one of hottest areas of Internet-commerce today. With most organizations spending at least one third of their overall budget to purchase goods and services, procurement savings hold significant business value. In this thesis, we provides a brief overview of e-commerce technologies, and presents the summary of results from a survey study of small and medium organizations. The results are based on a survey of about 35 companies during the period Sep 2000 – Oct 2000. The survey covers issues related to identifying current adoption factors to moving ordering onto the Internet and current issues that have to be overcome in order to gain wide spread adoption.

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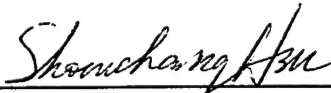B.S., Taiwan Naval Academy, 1989

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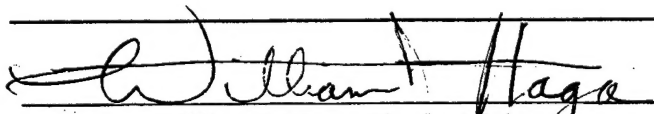requirements for the degree of

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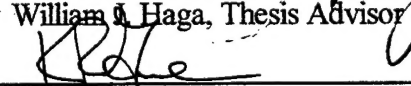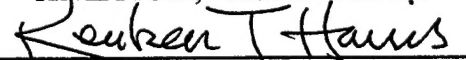
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iii

ABSTRACT

Innovative technologies such as the Internet and World Wide Web are raising hopes of changing the picture of inefficient, complex and costly ordering processes and improving them in terms of quality, flexibility, and lead-time. The market of systems and services to support business-to-business relationships, in particular procurement processes, is one of hottest areas of Internet-commerce today. With most organizations spending at least one third of their overall budget to purchase goods and services, procurement savings hold significant business value. In this thesis, we provide a brief overview of e-commerce technologies, and present the summary of results from a survey study of small and medium organizations. The results are based on a survey of about 35 companies during the period Sep 2000 – Oct 2000. The survey covers issues related to identifying current adoption factors to moving ordering onto the Internet and current issues that have to be overcome in order to gain wide spread adoption.

TABLE OF CONTENTS

LIST OF FIGURES

x

LIST OF TABLES

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I.   INTRODUCTION

A.   INTRODUCTION

1. What is the problem?

The commercialization of the Internet has resulted in the rapid growth of business-to-business electronic commerce. Forrester Research Inc. predicts that business-to-business Internet commerce will grow to $327 billion, or 2.3% of gross domestic product, by the year 2002 (Business Week, 1998). Forrester further predicts that this could grow to as much as 6% of GDP by year 2005. This positive outlook is most often attributed to the favorable demographics of computer-savvy U.S consumers (Hoffman, et al., 1996). But, the current discourse is seldom influenced by those who warn that the current investments in Internet-based commerce by large corporations do not match their growth expectations (Management Accounting-London, 1996). More importantly, the current electronic commerce projections do not clearly distinguish between expectations for business-to-business and business-to-consumer segments of the market. The emerging Internet retail systems are based on an individual with a web browser making a single purchase. But business-to-business transactions have involved sophisticated mainframe and EDI-based systems designed for batch processing of large transaction volumes. It is this business-to-business marketplace that is often omitted or misunderstood in the myriad discussions about the future of the electronic revolution.

Traditionally, purchasing operated as a stand-alone function and its activities were confined to receiving buying requests from internal users and translating these into purchase orders or other contractual relationships with suppliers. Most purchasing was a reactive, paperwork intensive clerical function, which focused on transaction processing. In a relatively stable and transparent environment, purchasing decision-making was fairly simple and addressed short-term operational issues mainly. Nevertheless, even in that stable environment, inefficiencies existed both in terms of purchasing processing and leveraging buying power with suppliers.

2. What does this thesis propose to do about it?

In recent years, however, purchasing has undergone a change from an operational function to a more strategic one. The contemporary philosophy of purchasing role is almost diametrically opposed to the "traditional" view. In the new strategic model, purchasing role is to manage the process, rather than merely process its transactions. Influenced by this transition from operational towards strategic procurement, organizations increased the number and scope of automated procurement applications.

The goal of this thesis is to investigate how Small and Medium Enterprises (SMEs) can reap benefits from the adoption and diffusion of IT within their organizations. The study provides information about the reasons why SME managers are reluctant to adopt Internet technologies. By identifying the major inhibitors this study may help government and industry bodies to provide appropriate information and support and thus enhance e-commerce technology adoption by SMEs.

2

3. What happens if the problem is not solved?

Procurement is one of the most important functions for both governmental and private sector business processes. However, it has become clear that it can in fact hold strategic business value (Taylor and Volney, 1997). The increasing pressure that companies are experiencing as markets become more global and competition intensifies triggered this change in notion. To keep up with fast changing market requirements companies need to react fast and efficiently. Innovative information systems not only help to speed up business processes and to cut costs, but also open up the way to new business concepts.

Procurement is well suited for the use of information technology for three reasons: (1) The exchange of goods and services between organizations (Williamson, 1985), revolves to a large degree around communication and information processing between organizations (buyers, suppliers, and third parties) as well as (2) within, e.g., between the procurement group, end users, and accounting (Nissen, 1996). (3) In addition, procurement processes are often highly repetitive and standardized, and in many cases involve items that are easy to describe (Zenz and George, 1994).

Overall, new technologies allow an organization to quickly catch up with its competition and service. However, if not used, they can become a potential source of strategic disadvantage. If its competitors offer services or products through the Internet for instance, and its does not, customers might switch suppliers, especially in industries where switching barriers are low. The adoption of electronic commerce (EC) technologies is important for their on-going survival. For instance, an adoptor customer might decide

3

to switch banks if one can offer him electronic banking capabilities, such as electronic bill payment, interactive on-line bank statements with information on companies stock. In addition, e-commerce technologies provide a cost-effective way for organizations to market their business, launch new products, improve communications, gather information, and identify potential business partners (Hawking, 1997). These advantages for adoption organizations could be the potential disadvantages for non-adoption organizations. The only source of sustained advantage comes from having an IT infrastructure, both technical and organizational, which allows for continuous innovation, to be in front of the competition.

B.   BACKGROUND

In a competitive business environment, communic ation of information plays a critical role and is responsible for the success of a distribution channel. Communication can be divided into two categories, (1) within an organization, (2) between organizations. For retail distribution and for chain stores in particular, the internal information that is communicated includes item price data, sales data, and a range of stock keeping information. The information can be gathered or processed automatically by bar-code machines and Point of Sales (POS) systems. Chain stores and international retail enterprises are leaders in the installation of high technology information systems. For small and medium-size retail enterprises, the transmission of messages internally and communication externally with suppliers is usually manual and paper-based (i.e. phone and fax). Although the use of Value Added Networks (VANs) in large and medium

4

enterprises has grown over the twenty years, there has been little incentive and little profit for their use by the Small and Medium Enterprises (SMEs). The greatest advantage for large organizations consists of transmitting messages via the VAN using EDI (Electronic Data Interchange) standards (Barber, 1997). Usage fees and VAN technology requirements push the widespread implementation out of the reach of small organizations.

A supplier's goal is to satisfy the demand of many retail stores. The daily routine of handing phone orders and incoming faxes is not only inefficiency but also costly and time-consuming (Segev, et al., 1996). Regardless of whether the organization is a supplier, a distributor, or a manufacturer, each has to meet the customer's needs for convenience, efficiency, and reduced labor. In the general process of ordering, Ballou (1992) reports that processing is represented by activities such as: (1) order preparation, (2) order transmittal, (3) order entry, (4) order filling, (5) and order status reporting (Figure 1).

The provision of efficient services while completing the activities of the order cycle is a key reason why retailers choose particular suppliers (Ballou, 1992).

```
┌──────────────────────┐      ┌──────────────────────┐      ┌──────────────────────────┐
│ Order preparation    │      │ Order Transmittal    │      │ Order Entry              │
│ -Requesting products │ ──▶  │ -Transferring order  │ ──▶  │ -Stock checking          │ ──▶
│  or services         │      │  information         │      │ -Accuracy checking       │
│                      │      │                      │      │ -Credit checking         │
└──────────────────────┘      └──────────────────────┘      │ -Back ordering/order     │
                                                            │  Canceling               │
                                                            │ -Transcription           │
                                                            │ -Billing                 │
                                                            └──────────────────────────┘
```

┌───┐
│ **Order filling**   │
│ -Product retrieval, production, or   │
│ purchase   │
│   -Packing for shipment   │
│   -Scheduling for delivery   │
│ -Shipping document preparation   │
│   │

```
┌──────────────────────────┐      ┌─────────────────────────────────────────┐
│ Order Status Reporting   │      │ Order filling                           │
│ -Tracing and tracking    │ ◀──  │ -Product retrieval, production, or      │ ◀──
│ -Communication with      │      │  purchase                               │
│  Customer on order status│      │   -Packing for shipment                 │
│                          │      │   -Scheduling for delivery              │
└──────────────────────────┘      │ -Shipping document preparation          │
                                  ├─────────────────────────────────────────┤
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                                                       │
                                           **Physical Distribution**
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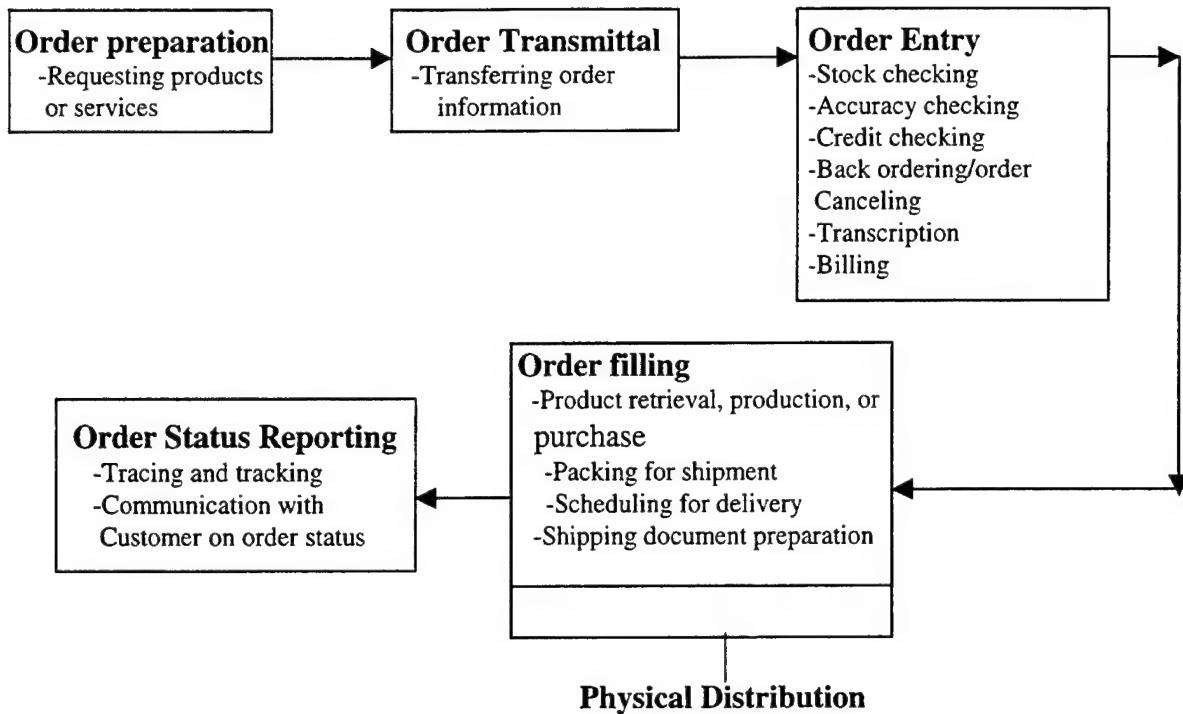
Figure 1. Typical elements of order processing (From Ballou, 1992)

Information Technology (IT) speeds up operations and cuts costs in a global marketplace. Technologies, such as the Internet and the World Wide Web (WWW), offer new opportunities to replace costly, time-consuming and inefficient ordering processes. An Electronic Ordering System (EOS) cannot only help retailers procure products through VAN or Internet, but also encourage the standardization of product data in the distribution channel. For SMEs, a VAN-based EOS is too expensive to implement, especially while dealing with a large volume of messages. The reason it is too expensive is that a VAN service provider frequently uses character-based pricing, whereas an Internet Service Provider (ISP) uses a time-based charge. With the global trend toward

building and improving the public information infrastructure, operations on the "information highway" run faster and the cost of access to the Internet remains low. Thus, ordering products and service via the Internet is a means to speed up and facilitate the buying process and to reduce human errors.

Nevertheless, an emerging technology has the tendency to satisfy some people's needs and trouble others simultaneously. In recent years, network technology has silently but with great impact changed people's lives and organizational processes. Using network technology, an Internet procurement system can be applied to the ordering process of retail stores. The ordering system, as a part of Electronic Commerce (EC), is a business-to-business application planned as a component of the National Information Infrastructure (NII). However, there exist many problems implementing the plan of many countries for an NII. For example, the network bandwidth may be not wide enough for a number of users, the security of commerce on the Internet may be poor, the laws governing EC may be non-existent, and people may resist change from a paper-based system to a network-based electronic system.

The Pharmaceutical, Grocery, Appliance, and Stationery (The voluntary chain of stores and franchises), are four major strategic alliances. Those in the voluntary ordering alliance began separately their operations in 1995-1996. They each provide more than 2,000 types of products to their members via an Internet-based electronic ordering system. But less than 60% of the alliance members use the ordering system to order products. The majority of the store managers are ordering by phone or Fax even though using an Internet-based ordering system offers accuracy, security, efficiency, and speed.

7

This research proposes that there are barriers (based on usage, value, perceived risk, and psychology) that slow a manager's adoption of an ordering system.

In the modern global business market, the collaboration and cooperation of suppliers and retailers is required to profitably manage dynamic commercial circumstances. The automation of message processing between firms can improve collaboration and cooperation. But one may ask, what are the barriers to adoption of an ordering system for store managers? How can the results of the survey of the barriers to adoption be used to build a user-friendly ordering system? What are the obstacles to moving ordering onto the Internet? These are the central research questions pursued in this thesis.

Since 1980, the chain store retail format has become so popular that it has emerged as a global standard. Thus, suppliers have had to change their operations to handle larger volume requests in less time and with fewer people. How can a supplier satisfy the demand of hundreds of customers requesting thousands of products in less time? To achieve acceptable levels of service, quick response technologies, such as Electronic Data Interchange (EDI) and Point of Sales Systems (POS), have been implemented in many large organizations (Ko and Kincade, 1997).

The traditional model of information exchange between retailers and suppliers (Figure 2) shows that the supplier needs to accommodate the exchange standards to all of its member retailers. Thus, the suppliers may communicate with Retailer A using a computer data format, but may use paper-based correspondence with Retail B. For yet another, the supplier may even have to use a dedicated computer system. For the supplier,

8

it is hard and time-consuming to integrate orders using different data formats, as well as different processes and procedures. Every time a new communication channel is created, particularly when the channel requires dedicated or specialized communication protocols and procedures, new costs are incurred.
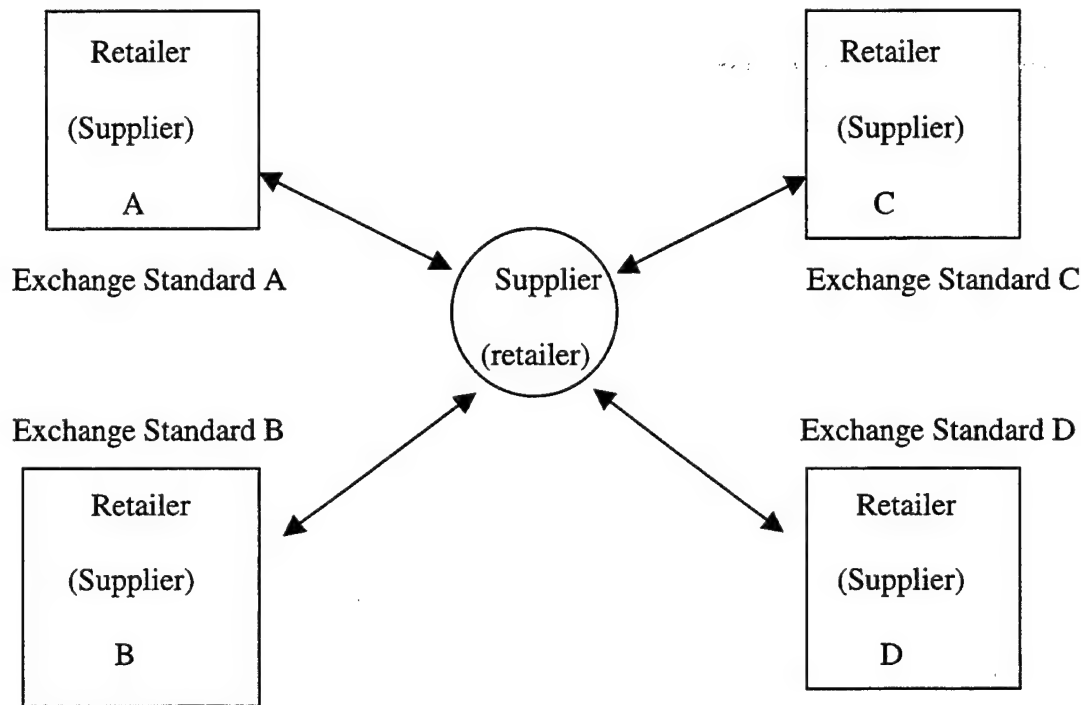

Figure 2. Traditional model of data exchange between a supplier and

its Customers

Figure 3 shows channel communication using a standard protocol (e.g. HTTP via the Internet) and established ordering procedures via a virtual warehouse. This is a " virtual warehouse" on the Internet from which retailers can order by submitting an electronic form via the Internet.

There are several benefits for using a "virtual warehouse" to order products:

1. A virtual warehouse offers 24-hour services. No matter when the need arises, the retailer can see the product catalog and place an order. By interfacing the order system with logistics providers, the ordered mechandise can be automatically scheduled and quickly shipped.

2. A virtual warehouse offers global ordering services. Due to the unbounded attributes the Internet, people can order products from foreign countries without going abroad. This attribute gives SME's the opportunity to enlarge their market share and spread their retail operations across borders.

3. A virtual warehouse can automatically aggregate retailer requests and transmit large purchase orders to the database of the suppliers. Using electronic accounting and order placement reduces humans errors. For suppliers, aggregated orders facilitate inventory and procurement management.

4. A virtual warehouse provides a standard electronic form and ordering procedures. Standardization helps to eliminate unintentional errors such as omission.
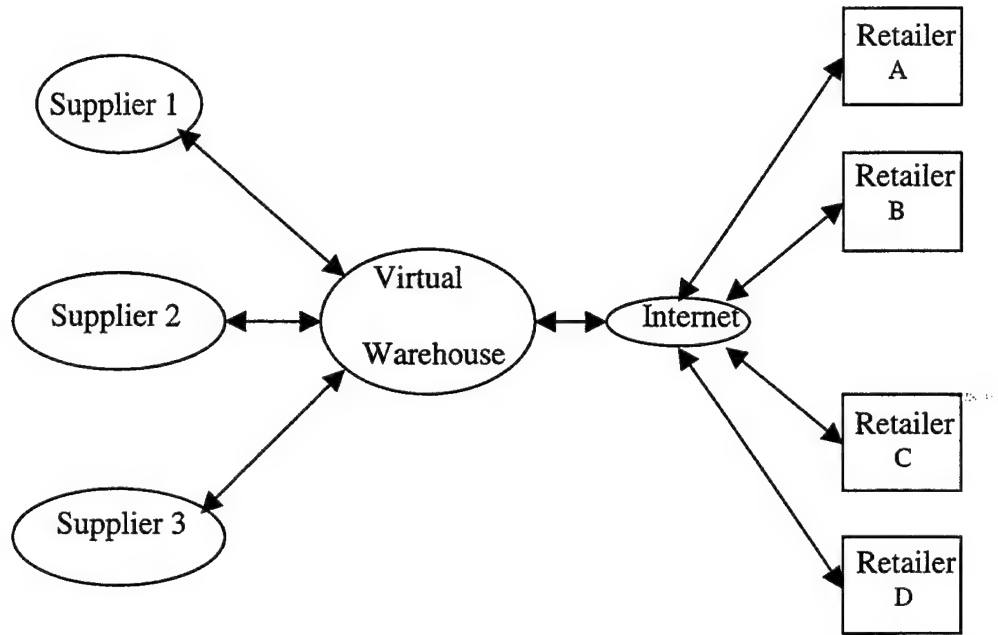
Figure 3. Transmitting documents in a standard format

The benefits of a virtual warehouse appear significant enough to lead to industry wide adoption. However, Forrester Research (Bers, 1996) reports that, while more than 80% of American firms had a web site at the end of 1996, only about 5% of the firms were actually conducting business transactions using their Web sites. A key to the success of electronic commerce systems is certainly the customer's adoption of technologies. Bloch, et al., (1996) proposed a framework of factors affecting new technology adoption, e.g. technologies, suppliers, customers, usage barriers, and alternative solutions (Figure 4). The figure shows some of the factors linked to new technology adoption by consumers (the factors adversely affecting adoption are *italics*). Basically speaking, these possible factors should be taken into account when implementing new technology.

11
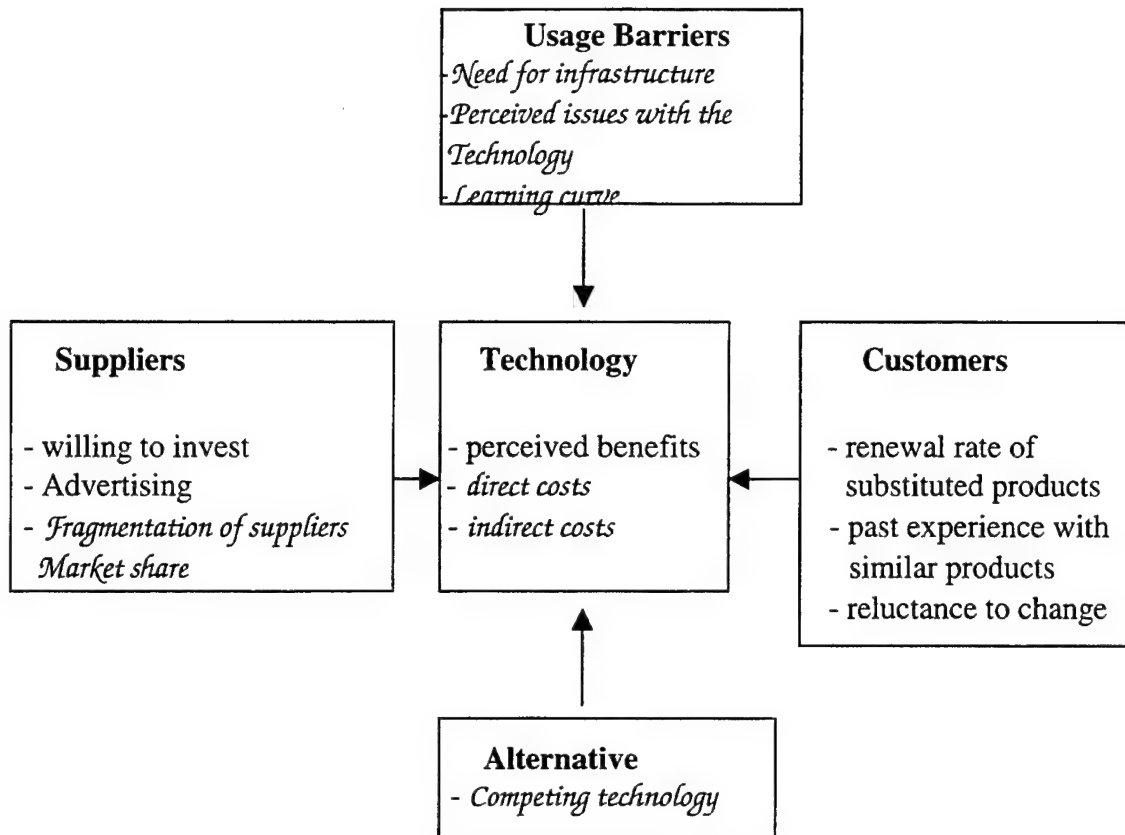
Figure 4. Factors affecting new technology adoption (From Bloch, Pigneur, and Segec, 1996)

This research uses the case of chain store retailers as an example to illustrate and test concepts related to Internet-based electronic commerce. In order to capture the view of those chain retailers, the end user of new technology, a questionnaire is designed to measure barriers to the adoption of EOSs. What are the factors that chain store manager's report as barriers to use electronic ordering systems? What should the ideal attributes of

12

the ordering system be like? From the results of an end-user survey, we identify appropriate electronic ordering systems and analyze the barriers to adoption of EOS.

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II. LITERATURE REVIEW

A.   OVERVIEW OF ELECTRONIC COMMERCE

Bloch, et al. (1996) define electronic commerce (EC) as the buying and selling of information, products and service via computer networks. They also extend the definition of electronic commerce by including "support for any kind of business transactions over a digital infrastructure." Electronic commerce is not only the sharing of business information, maintaining business relationships, and conducting business transactions by means of telecommunication networks, but also the corporate processes that support the commerce and electronic messages within individual firms (Zwass, 1998).

The futures of Electronic Commerce (EC) systems are listed below:

1. Directly connect buyers and sellers, reducing the loss of information in the channel and improving cycle time (Ferguson, 1998).

2. Offer paperless and digital information exchange between transaction partners, which can reduce the human error rate.

3. Solve the problem of time and space limits.

4. Support dynamic and interactive user interface that can be adapted to customer behavior.

5. Offer real-time updates, which can make information continuously current.

EC is a trendy name, but is put into practice through the use of Electronic Data Exchange (EDI). EDI is the computer-to-computer exchange of standardized electronic transaction documents (Webber, 1998). In fact, electronic commerce has been

15

developed for at least twenty years with the evolution of EDI, and has expanded in the past several years with the spread of the Internet and the World Wide Web (Beam and Segev, 1996). Therefore, current EC can be regarded as the selling of goods and services over the Internet (Guay and Ettwein, 1998). Mark and Johnston (1998) indicate that traditional VAN-based EDI cannot be adopted by most of the SMEs, because it is built on private networks, and requires high set-up cost, transmission charges, as well as proprietary technology. Ferguson's research (1998) indicates that two-thirds of all companies doing EDI were initially forced to apply it at the request of suppliers or customers. However, it does not mean that the Internet is the terminator of traditional EDI (Barber, 1997). The advent of the Internet makes the implementation of EDI fast and possible, especially for SMEs. Traditional EDI and the Internet are complementary, enabling companies to enhance their existing electronic commerce capabilities and increase trading partners (Tuten, 1997). With the emergence of Internet technology, the platform for data exchange is moved from closed private networks to the more open and less restrictive Internet.

B.   OVERVIEW OF EC ADOPTION

Lind (1998) indicates that there are six barriers to EDI technology adoption: (1) implementation procedure issues, (2) organizational issues, (3) technical issues, (4) work process issues, (5) and market potential issues. Also, (6) being afraid of change and not knowing the perceived benefits from EDI creates barriers to EDI implementation. Beam and Segev (1996) point out that the public perception of the risk, e.g. security and fraud,

16

is a crucial element in adopting. Porter and Cauffiel (1997) found two inhibitors to the expansion of electronic commerce: (1) a cultural aspect and (2) a technical aspect. Their research proposes the primary inhibitors: (1) security of transactions, (2) reliability of transactions, (3) accuracy concerns, (4) authentication, which can be resolved by protocol standardization, digital signatures and encryption. Kang (1998) proposes that the preparatory scheme of complete access to the Internet is vital to the EC adoption. The factors identified by Kang are: (1) organization size, investment capability, and IT expertise, (2) installed IT base (e.g. MIS), and (3) nature of interactions with external organizations.

Mason (1997) applies theories of organization decision-making and organization learning to identify the reasons of SMEs electronic commerce technology adoption:

1. An SME decides to adopt new technologies based on perceived benefits and costs that are established by the firms' perceptions. Thus, the author suggests that SMEs work with innovators or early adopters to lower barriers to adoption.

2. The integration of technology and people in a new system is a challenge and risk for SMEs. Thus, the learning ability of the staff involved in the implementation of electronic commerce technology must be considered.

C.   OVERVIEW OF ADOPTION BEHAVIORS

Wells and Prensky (1996) classify new product innovations into (1) continuous innovations, (2) dynamically continuous innovations, and (3) discontinuous innovations

17

(Wells and Prensky, 1996). These three categories are defined by the degree to which they embody technological and behavioral changes (Figure 5)

Behavioral Change

Technological Change
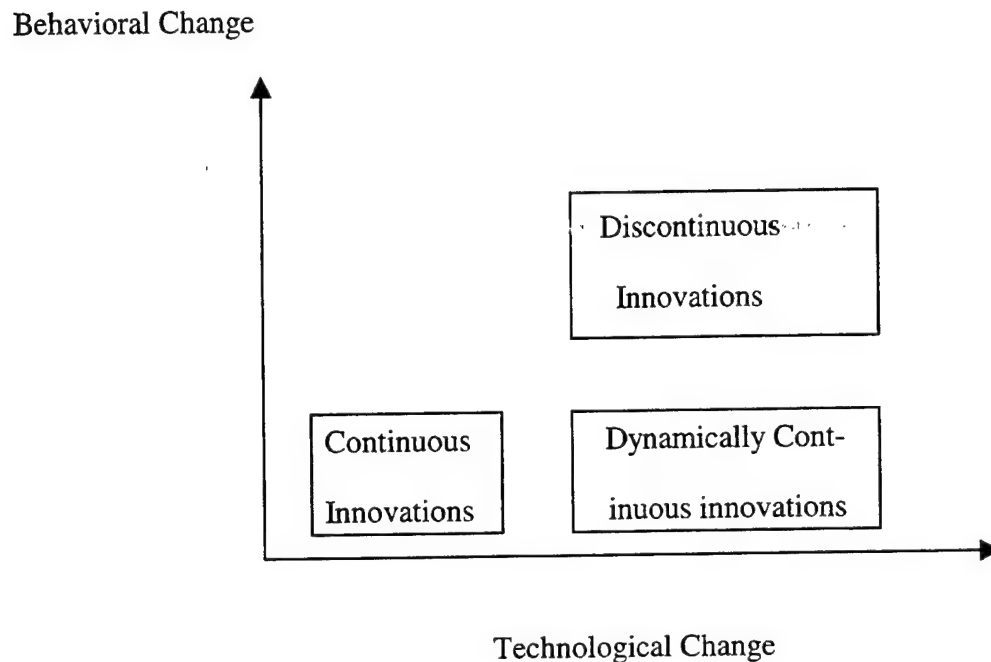
Figure 5. Types of new product innovation (From Wells and Prensky, 1996)

1. Continuous Innovations:

The degree of technology change embodied in a product can differ from the degree of behavioral change required by the consumers of technology. A continuous innovation is the modification of an existing product, which involves little technological innovation and little behavioral change. An example of a continuous innovation is now seen in the automobile industry as it continuous to change and develop.

2. Dynamically continuous innovations:

A dynamically continuous innovation involves a new product that provides some technological change or new benefit but requires little or no behavioral change. An example of this type of innovation would be compact discs.

3. Discontinuous innovation:

A discontinuous innovation involves a new product that provides some technological change or new benefit and requires new consumer purchase and usage behaviors. An example of this type innovation is the original video tape recorder, the fax machine, and the lithium battery pacemaker. An Internet-based ordering system is a discontinuous innovation because it introduces new technology and requires significantly different behavior on the part of the consumer.

Due to the scarcity of academic research pertaining to Internet-based ordering system technology adoption, the foundation for survey design to measure factors of adoption is derived from the related literatures. According to models, technology is adopted after the adopting person moves through stages: cognitive, affective, and behavioral (Williams and Rao, 1997). In the cognitive stage, managers and executives of the firm mentally consider or are exposed to the technology. After managers become aware of the technology's existence, the firm moves into the affective stage. This stage is based on managers' feeling toward the technology. If feelings are favorable, then the firm will move into the behavioral stage and adopt the technology.

The AIDA model (Strong, 1925) proposes that the firm first becomes "aware" of the technology. This awareness leads to "interest". It is the interest in technology that

19

creates a "desire" for the associated benefits. The desire for benefits accrued through the use of technology leads to "action" to adopt technology.

The Innovation Adoption model (Rogers, 1962) provides a perspective on the consumer purchase activities involved in the adoption of a new product. According to the model, the adoption of a new product occurs in five stages: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation.

Another model is the Communications Model (Kotler, 1984). In the awareness stage, the adopting firm becomes exposed to the technology. The exposure to technology will create a perception of the technology. The perception will lead in turn to a cognitive or mental response. As the firm moves into the affective stage, an attitude about the product is formed. Finally, the attitude leads to action.

From those models, the basic constructs of the adoption process are derived. These constructs are awareness, benefits, technology use, organizational openness, demand drivers, and evaluation. Additionally, Ram and Sheth (1989), as well as Ellen, et al. (1991) enumerate four barriers to adoption: (1) usage, (2) value, (3) perceived risk, and (4) psychological barrier, which are defined in Table 1.

Table 1. Construct Definition

Construct	Definition
Usage Barriers	A product faces a usage barrier when consumers refuse to adopt a new product because it is incompatible with their existing behaviors.
Value Barriers	Consumers tried to resist adopting new products that do not offer better value than their existing alternatives.
Perceived Risk	Consumers may be reluctant to adopt a product if their feel Uncertain about their purchase and usage of the product.
Psychological Barriers	Consumers may hesitate to adopt a new product as a result of psychological barriers that stem from their prior attitudes and image.

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III. EMPIRICAL STUDY

A.   METHODOLOGY AND TOOLS

According to Table 2, we can enumerate four barriers to adoption (usage, value, perceived risk, and psychological) and create a questionnaire (See Appendix A). Table 2 illustrates the relationship between questions and constructs.

Table 2. Relationship between the questions and constructs

Constructs	Questions
Usage Barrier	1~4
Value Barrier	5~8
Perceived Risk	9~12
Psychological Barriers	13~16

To accomplish the rather broad goal, we developed a paper-based questionnaire, which my colleagues and I used to collect data (primarily between August and October 2000). This research is based on this set of data.

The questionnaire was built as a paper-based survey form. The questionnaires used in this survey is a modified and improved version of the " Procurement in the Internet age – Current Practices and Emerging Trends" which was created at The Fisher Center (University of California, Berkeley) in California, in 1998, by Segev, et al. (1998).

The following changes were introduced: (1) directions were provided on the first page; (2) a new layout was produced to clarify questions; (3) 16 questions were added on areas of research; (4) and the questionnaires was translated into Chinese for the Chinese-speaking respondents. The 3-page questionnaire was printed in the form of a letter-size booklet. My colleagues (Deborah Lee and Sheilla Hsu), who work in Anderson Consulting Co. in Taiwan, addressed retail purchasing managers with face-to-face interviews; the participants then were able to fill out the form during the interviews. The survey was prepared in either English or Chinese depending on the participation.

B.   RESEARCH QUESTION AND STUDY DESIGN

The goal of this research was to document the barriers to adoption of Internet and information technology on current ordering system and to identify the attitude of organizations towards new information technology as well as obstacles of utilizing new systems for procurement. This includes a look at how procurement processes are organized today as well as the current role of information technology and the Internet.

The study attempts to answer the following research questions:

1. What are the barriers of the adoption of the Internet-based ordering system?

2. What is the perception of the Internet's potential to help improve procurement?

3. Basic information about the company, such as line of business.

As a first step, we conduct an empirical survey among organizations using face-to-face interview with retail purchasing managers, and literature research. The results

reported here are based on 35 responses. The small sample limits the depth of possible interpretation of the results, as does the fact that it is somewhat skewed towards organizations that can be considered rather open towards the use of new technologies. This is due to many factors, including the fact that limited time and organizations that took the time to respond to the survey were likely to have made IT use in procurement a priority.

C.   ANALYSIS STRATEGY

The barriers to adoption are related to the actions of decision makers and the test subjects are store managers who use paper or phone systems to order products. Prior to the test, a brief description of an Internet ordering system is given. The age limit of the managers is below 45 years old to eliminate the effect of age on the adoption of new products. In the case, 35 managers were interviewed. In order to predict how long a test takes and to make out survey field procedures, a pretest of 5 surveys was conducted.

The test method was face-to-face interviews. In order to ensure the precision of the test, each survey should have to be tested at a fixed time (e.g. 7 p.m.) and each survey required less than 15 minutes of time to complete.

D.   RESPONDENT PROFILES

A brief background summary of the responding companies is useful to put the data within a meaningful context. The results here are based on 35 companies and dominated

by grocery, drug, appliance, and stationary companies. The participating companies cover a narrow range of business types and sizes.

1. Business Areas

The entire sample is 35 data points, and is dominated by grocery, drug, appliance, and stationery companies (Figure 6).
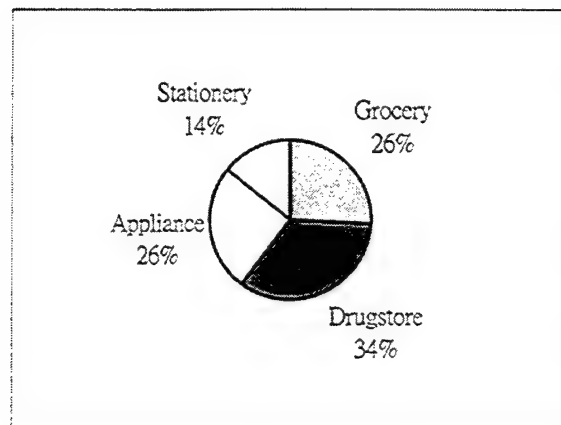
Figure 6 - Main Lines of Business (Full Sample)

The participating organizations cover a narrow range of business types with Grocery store (26%), Drug store (34%), Appliance store (26%), and Stationery store (14%) accounting for the biggest chunks.

2. Size

The size of the companies varied over a broad range. There were three measures – the annual sales volume, the annual purchasing volume, and Number of employees – which were combined and collapsed into a single measure of size. In case of conflicting data, a higher weight was placed on the purchasing volume. This is show as in Table 3.

26

Size	Annual sales	No. Employees	Annual Purchase
Small	$10 M or less	500 or less	$1 M or less
Medium	$10M - $1 B	500 – 10,000	$1 M - $50 M
Large	$1 B or more	10,000 or more	$50 M or more

Table 3 – Size Categories

Overall, the respondents were rather evenly spread among small (56%), medium (44%)companies.

3. Who Filled in the Survey?

Both marketing managers and purchasing managers were invited to fill it out. Purchasing managers filled out over 80 % of the full sample; the IT managers and 6% of the others filled out only 14 % of the full sample. (Figure 7)
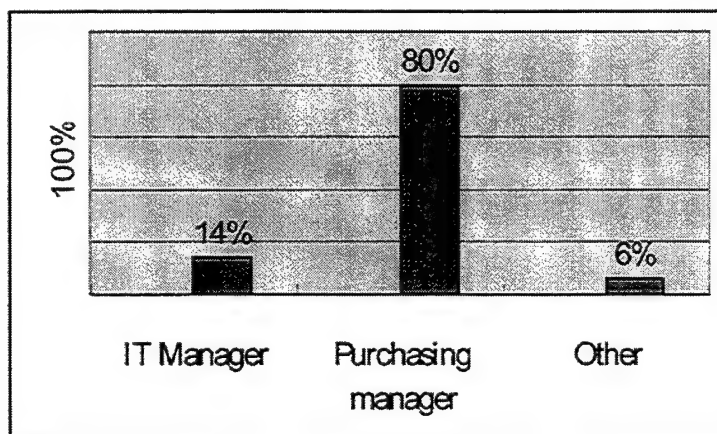
Figure 7 – Survey Participants

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IV. FINDINGS

1. Compatibility with the original systems

We asked the participants about the compatibility with the organization's original systems, the average respondent rated their compatibility as a 3.74 on a scale of 1 (Not important) to 5 (Extremely important) (Figure 8).
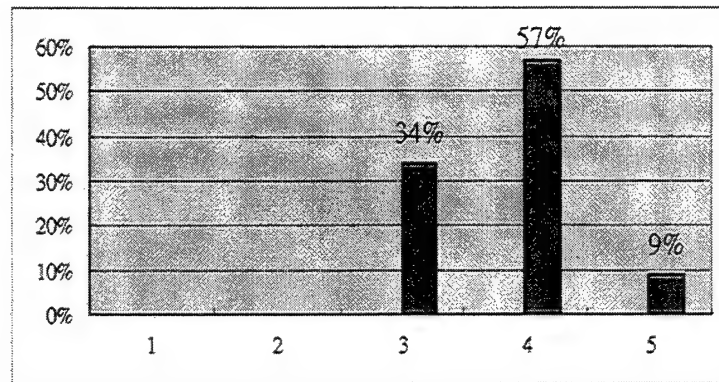
Mode: 4

Median: 4

Mean: 3.74

Figure 8 - Compatibility with the original systems

2. Ease of learning

Asked about the ease of learning of the systems, the average respondent rated their level as a 2.31 (Figure 9).
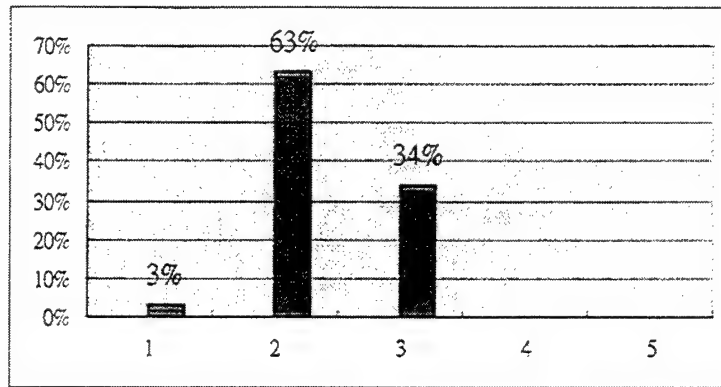
Mode: 2

Median: 2

Mean: 2.31

Figure 9 - Ease of learning

3. Ease of use

Asked about ease of use the systems, the average respondent rated their level of

systems as a 3.05. (Figure 10)
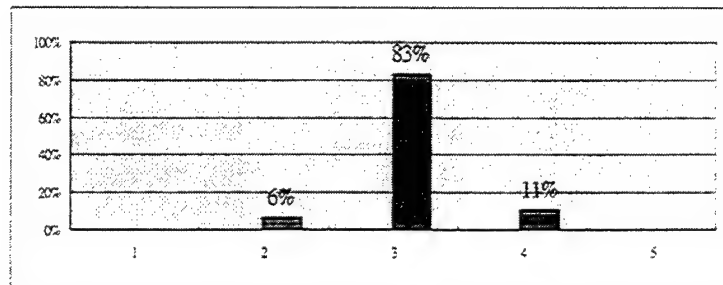
Mode: 3

Median: 3

Mean: 3.05

Figure 10 - Ease of use

4. Durability of the systems

Asked about the durability of the systems, the average respondent rated their level as a 2.25. (Figure 11)
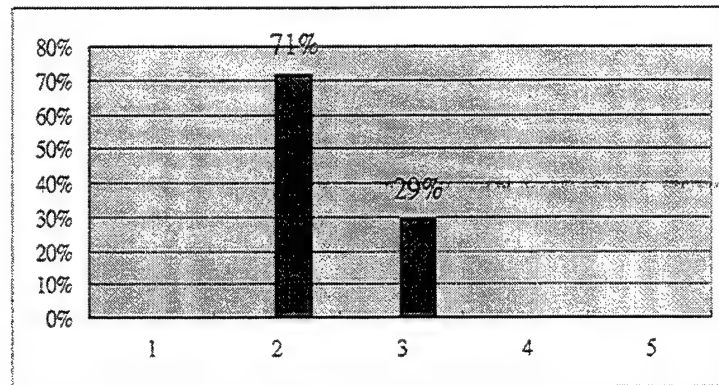
Mode: 2

Median: 2

Mean: 2.25

Figure 11 - Durability of the systems

5. System cost

Asked about the initial set up costs (system cost), the average respondent rated their level as a 4.0. (Figure 12)

Mode: 4

Median: 4

Mean: 4

Figure 12 - System cost

6. **Charge rate**

Asked about the monthly charge rate for usage of system, the average respondent

rated their level as a 3. (Figure 13)
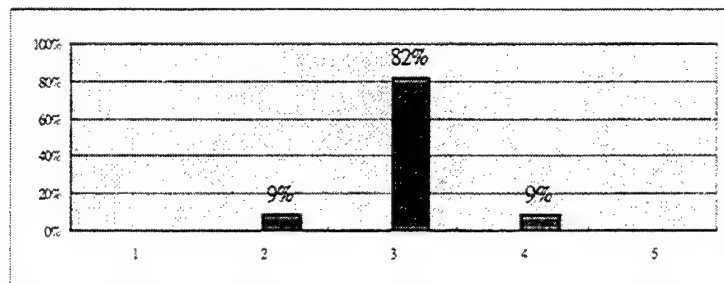
Mode: 3

Median: 3

Mean: 3

Figure 13 - Charge rate

7. Response time of the system

Asked about the response time of the system, the average respondent rated their

level as a 3.65. (Figure 14).
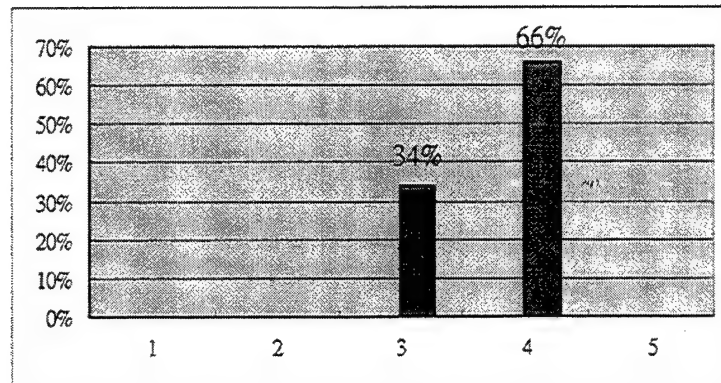
Mode: 4

Median: 4

Mean: 3.65

Figure 14 - Response time of the system

8. Accuracy of information

Asked about the accuracy of the information, the average respondent rated their

level as a 3.51. (Figure 15)
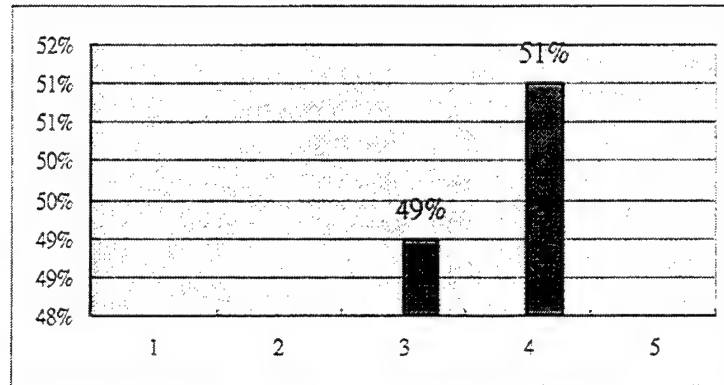
Mode: 4

Median: 4

Mean: 3.51

Figure 15 - Accuracy of information

9.   **Security of transactions**

Asked about the security issue of the systems, the average respondent rated

their level as a 4.43. (Figure 16)
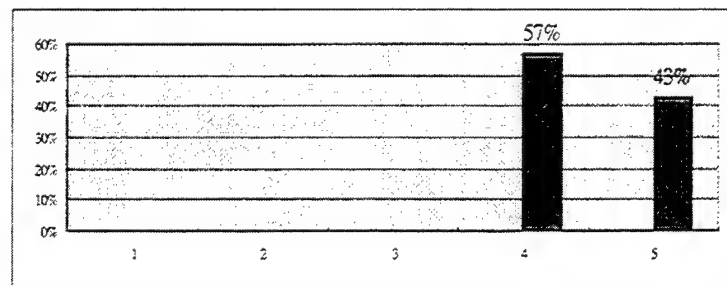
Mode: 4

Median: 4

Mean: 4.43

Figure 16 - Security of transactions

10. **Authentication**

Asked about the authentication of the completion of transactions, the average respondent rated their level as a 3.02. (Figure 17)
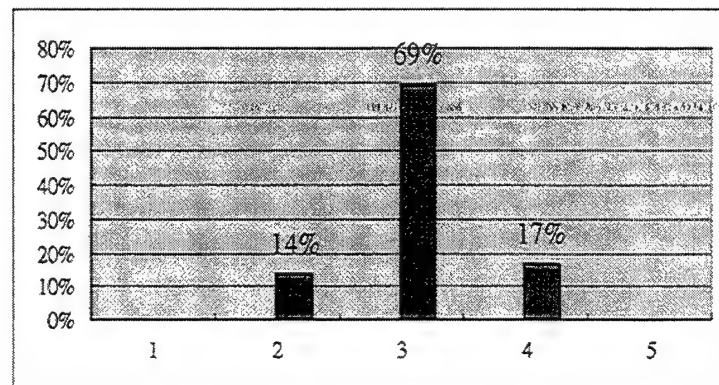
Mode: 3

Median: 3

Mean: 3.02

Figure 17 - Authentication

11. **Reliability of the systems**

Asked about the reliability of the system, the average respondent rated their level as a 3.77. (Figure 18)
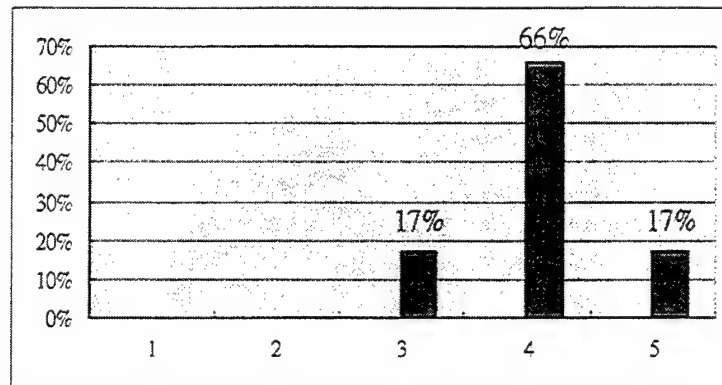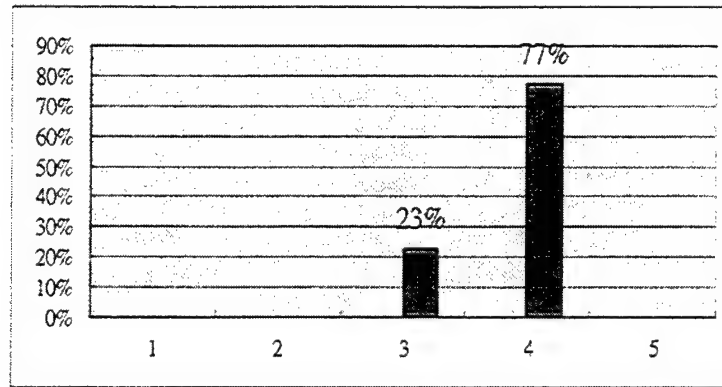
Mode: 4

Median: 4

Mean: 3.77

Figure 18 - Reliability of the systems

12. Privacy of transactions

Asked about the privacy of transactions, the average respondent rated their level

as a 3.54. (Figure 19)
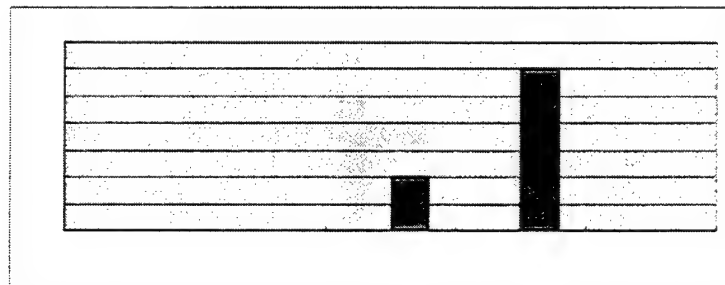
Mode: 4

Median: 4

Mean: 3.54

Figure 19 - Privacy of transactions

13. Matches your professional image

Asked about the IT would match your professional image, the average respondent rated their level as a 2.45. (Figure 20).
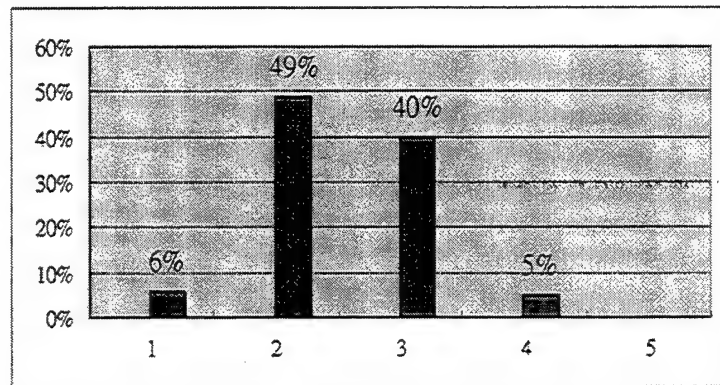
Mode: 2

Median: 2

Mean: 2.45

Figure 20 - Matches your professional image

14. Need more powerful information technology

Asked about the need more powerful Information technology (upgrade IT systems), the average respondent rated their level as a 4.08. (Figure 21)
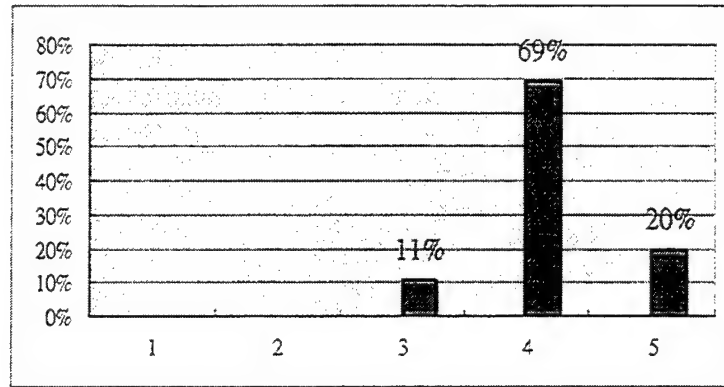
Mode: 4

Median: 4

Mean: 4.08

Figure 21 - Need more powerful information technology

15.   Need to work on the Internet

Asked about the need to work on the Internet, the average respondent rated their

level as a 3.14. (Figure 22)
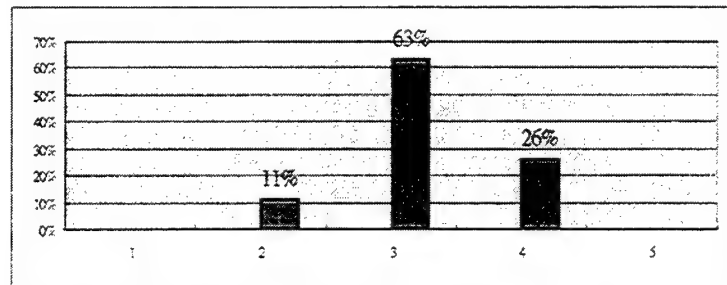
Mode: 3

Median: 3

Mean: 3.14

Figure 22 - Need to work on the Internet

16.   Business competition

Asked about the business competition, the average respondent rated their level as

a 3.85. (Figure 23)
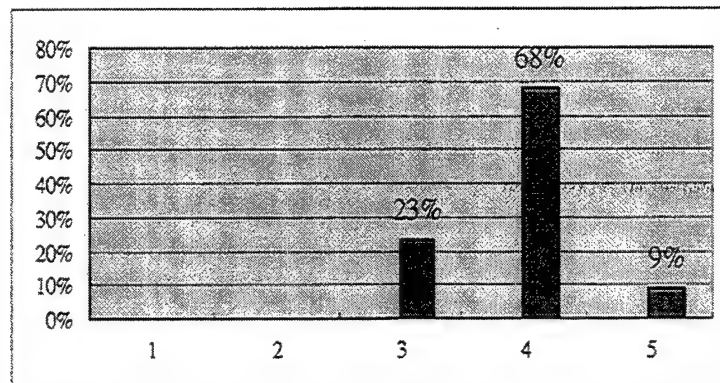
Mode: 4

Median: 4

Mean: 3.85

Figure 23 - Business competition

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V. DISCUSSION

The survey presented here was conducted to explore the factors of adoption of
new technology on the workplace in the SMEs. The participants were managers in the
SMEs with sizes varying from one to 600 employees. From the survey data that our
participants provided as well as from the comments, we found the most significant
barriers to electronic commerce (EC) adoption are (1) Concern with security of
transactions, (2) Need for powerful IT tools and systems, (3) High investment cost, (4)
Business competition: As shown in Figure 24.
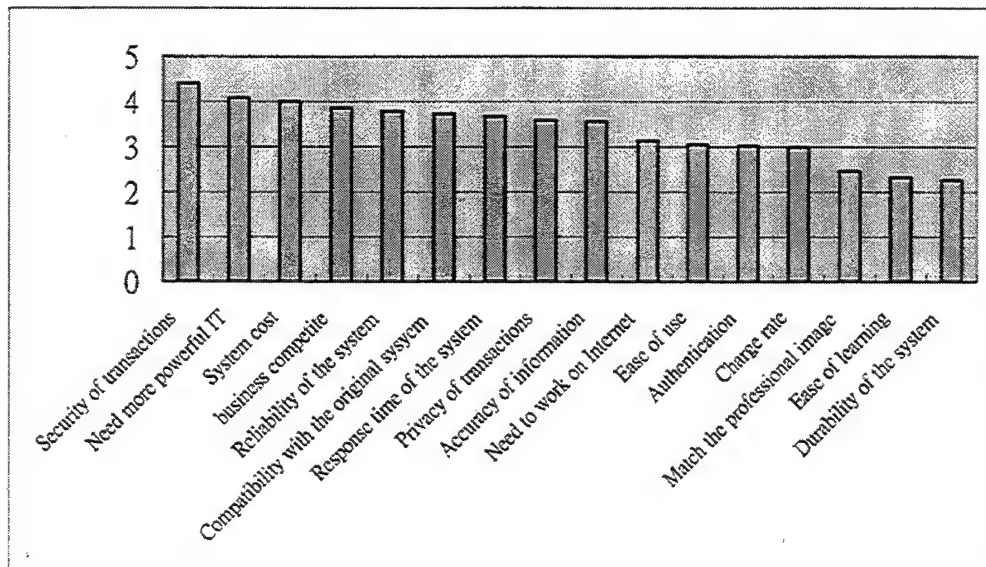
Figure 24 – Adoption factors of EOS

1. Concerns about security and reliability of electronic commerce:

Concern about Internet security emerged as an important inhibitor to the growth of
the e-commerce market. These concerns were felt most strongly in SMEs where legal and

security systems in general may be less well developed. On the other hand, firms with more developed e-business capabilities were generally less concerned about security due to greater awareness of appropriate technologies.

Smaller businesses fear IT unreliability and the likelihood of disk crashes and equipment failure.

2.   **High cost of computer and networking technologies:**

The capital cost of a PC and Modem is not really an issue for SMEs, nor is the cost of gaining access for on-line EC activities. For SMEs, where volumes cannot justify investment in integrated EC systems, the additional cost in relation to data receipt and transfer is considered an imposition, particularly when compared with general mail and fax. Further costs are incurred where SMEs largely continue to operate dual systems, paper and electronic based, as they discover the so-called "critical mass" of electronic trading partners has not yet eventuated.

3.   **Lack of the information technology tools and systems:**

SME management recognizes it is difficult to cope with the constant necessity to upgrade IT hardware and software. Capital expenditure to meet these changes is perceived as excessive. SMEs believe that the existing telecommunications and IT infrastructure is not complete as there are constant changes taking place and improvements being made. They are also concerned that current technology will be quickly superseded. However, there are greater challenges when there is a need to integrate EC technology into existing computer applications. Also, large amounts of data and many transactions may need more powerful IT are likely to push an organization into

adopting new technologies that can help to streamline operations and offer process efficiencies within the organizations.

4. **Business competition**:

In relation to the use of the Internet for electronic marketing, SMEs exhibit fear that their products and services may be more easily copied and cheaply produced by a competitor. If competitors and a whole industry are adopting IT, the SMEs are likely to adopt as well. On the other hand, if external pressure is lacking, the organizations may perceive the technology as a waste of resources. When a major supplier or customer adopts IT, business managers are more likely to adopt.

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VI. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

This thesis examined barriers to adoption and use of electronic commerce by small and medium enterprises and it identified measures which participating SMEs believe should be taken by government or organizations to facilitate greater adoption of electronic commerce by SMEs.

The analytical framework we used enabled us to explore and examine the similarities and different perspectives between SMEs. The following suggestions for further research could include:

1. A focused understanding particular opportunities and challenges for SMEs adoption of e-commerce within an industry (e.g. financial services, transportation, communications, retail sales, software development, manufacturing) would assist SMEs in development policies or programs to encourage e-commerce uptake among SMEs within that industry.

2. A typology and analysis of business models, business networks and communities of interest that would provide SMEs with understanding of the range of business models and e-commerce options that are available.

3. Greater access to international customers and markets is a key potential benefit of electronic commerce for SMEs. A study of the opportunities and impediments for international trade among SMEs would help countries develop their e-commerce trade policies and program.

4. A periodic survey of SMEs perceptions of e-commerce opportunities and barriers in industry would assist government and organizations to develop measures that are current with rapid development of e-commerce.

B. RECOMMENDATIONS

Based on the research, the following recommendations are made:

1. Developing the telecommunications infrastructure to improve business and consumer access to the Internet and to electronic commerce. This action was particular important for SMEs. Specific initiatives might include encouraging the development of Internet Service Providers (ISPs) and regulatory reform to increase competition in the provision of telecommunications services and encourage lower rates and service innovation.

2. Enhancing security issues to build trust and confidence in the electronic marketplace, including ensuring the authenticity of electronic documents, and the privacy and confidentiality of personal and organization records.

3. Establishing the domestic market for electronic commerce. This step might include ensuring consumer and supplier access to the Internet and appropriate other electronic systems (such as ordering or payment systems), the enhancement of consumer protection and the maintenance of good business practice in electronic commerce.

4. Electronic commerce allows SMEs to market their products or services directly to business and consumers throughout the world. However, this approach should

only be implemented when SMEs have developed the capabilities and taken all necessary steps to supply the international market.

5. The Internet can be used to form closer partnerships with complementary businesses, either domestic or international. For example, SMEs may be able to overcome high costs of entry and concerns about security issues by participating in web-based networks of buyers or sellers.

6. While SMEs commonly think about the Internet as a means of reaching more customers, the most immediate business case may be cost reduction, such as looking for additional sources of supply or cheaper materials purchases. Using the Internet for this purpose generally requires less investment than creating and maintaining a web site for product sales or services.

7. SMEs in particular might concentrate initially on business-to-business electronic commerce where other businesses are the main customers or suppliers. This focus may be necessary until the domestics (and international) customer market develops sufficiently to sell specific products or services to consumers.

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APPENDIX A. SURVEY INSTRUMENT

Purpose:

This questionnaire is designed to explore the common opinion of the chain store purchasing managers adopting Internet-based Electronic Ordering Systems (EOS). Please answer the questions below according to your feeling. Make a mark to represent your choice. Thank you for your help!

Time: 15 Minutes.

About You: The person fill out the survey is

Title: Company:

Address:

Email: Web address:

Please indicate the following quantities:

Annual corporate sales:

__ under $100,000   __ $100,000 - $500,000   __ $500,000 - $1 M   __ $1 M - $10 M

__ $10M - $100 M   __ $100 M - $500 M   __ $500 M - $1 B   __ $1 B $5 B

__ $5 B - $10 B   __ over $1 B

Number of employees:

__ under 50   __ 50 – 100   __ 100 – 500   __ 500 – 1000

__ 1000 – 5000   __ 5,000 – 10,000   __ 10,000 – 50,000   __ 50,000 – 100,000

__ over 100,000

Annual purchasing volume:

__ under $100,000   __ $100,000 - $500,000   __ $500,000 - $1 M   __ $1 M - $5 M

__ $5 M - $10 M   __ $10 M - $50 M   __ $50 M - $100 M   __ $100 M - $500 M

49

Questionnaire:

The following questions apply to your feeling about adoption of new information technology such as emerging Internet and World Wide Web (WWW) technology. Please answer the question to reflect your opinion of the Internet-based Electronic Ordering Systems (EOS). The left column indicates factors that affect your adoption. If you think the factors is very important, please select "CIRCLE" in the relative item of right column (1--5) or not apply (6).

<u>Questionnaire</u>

Criterion Item

1. **Compatibility with the original systems** (Technical compatibility with other system within the organization)

Not	less	Important	Very	Extremely	N/A
Important	Important		Important	Important	

(1............2............3............4............5............6)

3. **Ease of learning** (e.g. on-line tutorial)

(1............2............3............4............5............6)

4. **Ease of use** (user friendly)

(1............2............3............4............5............6)

5. **Durability of the systems**

(1............2............3............4............5............6)

6. **System Cost**(e.g. initial set up costs, Affordability of systems)

(1............2............3............4............5............6)

7. **Charge rate**(e.g. Internet connection fees)

(1............2............3............4............5............6)

7. **Response time of the system**
   (e.g. efficiency)   (1.............2.............3.............4.............5............6)

8. **Accuracy of information**(Ability to get exactly what you ordered)

                                        (1.............2.............3.............4.............5............6)

9. **Security of transactions**(e.g. Hacker modifies data)

                                        (1.............2.............3.............4.............5............6)

10. **Authentication** (confirmation)

                                        (1.............2.............3.............4.............5............6)

11 .**Reliability of the systems**

                                        (1.............2.............3.............4.............5............6)
12. **Privacy of transactions**

                                        (1.............2.............3.............4.............5............6)

13. **Matches the professional image**

                                        (1.............2.............3.............4.............5............6)

14. **Need more powerful information technology**

                                        (1.............2.............3.............4.............5............6)

15. **Need to work on the Internet**

                                        (1.............2.............3.............4.............5............6)

16. **Business Competition**

                                        (1.............2.............3.............4.............5............6)

17. **Please describe any other impacts you believe the Internet will have on you Business:**

If you would like to provide additional comments on the impact of the

Internet on procurement, Please do so below:

Thank you very much for your participating in our survey.

APPENDIX B. SURVEY DATA

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16
G1	4	2	3	2	4	3	4	3	5	3	4	3	2	4	3	4
G2	4	2	3	2	4	3	3	3	4	3	3	3	2	4	3	4
G3	4	2	3	2	3	3	3	4	5	3	4	3	2	3	3	3
G4	3	2	3	3	4	3	4	3	4	3	4	4	1	4	3	4
G5	4	3	3	2	3	4	4	3	4	3	4	3	2	4	3	4
G6	4	2	3	2	5	3	3	4	5	3	4	4	2	4	3	4
G7	3	2	3	2	4	3	3	4	4	4	4	3	3	3	3	5
G8	4	2	2	3	3	4	4	3	5	3	4	4	2	4	4	3
G9	4	3	3	2	4	3	4	4	4	4	3	4	3	4	3	4
D1	4	2	3	2	4	3	4	3	5	3	4	3	1	5	4	3
D2	3	3	4	2	4	3	4	3	4	3	4	3	3	4	3	4
D3	4	3	3	2	5	3	3	4	5	3	4	3	2	4	4	3
D4	4	2	3	2	4	2	4	3	4	2	4	3	3	4	3	4
D5	4	1	3	2	4	2	4	4	5	3	4	4	3	5	4	4
D6	3	2	3	2	5	3	3	3	4	3	4	4	2	5	3	4
D7	5	2	4	3	4	3	4	4	4	3	3	3	3	4	3	4
D8	4	2	3	2	3	3	4	3	4	3	3	4	2	3	3	4
D9	3	3	4	2	3	3	4	4	5	3	4	3	3	4	3	5
D10	3	3	3	2	4	3	3	3	5	4	3	4	3	4	2	4
D11	5	3	3	2	4	3	4	4	4	2	4	3	2	5	4	4
D12	3	2	4	3	5	3	4	3	5	3	3	4	2	4	3	4
A1	4	2	3	3	4	3	4	4	4	3	4	4	2	4	2	4
A2	3	3	3	2	4	3	4	4	4	3	4	4	3	3	3	4
A3	4	2	3	2	4	3	4	3	5	3	4	4	4	4	2	3
A4	5	3	3	2	4	3	3	4	4	2	4	4	2	5	4	4
A5	4	2	3	3	5	3	4	3	4	2	3	4	3	4	2	4
A6	3	2	2	2	4	3	3	4	5	3	4	4	3	4	3	3
A7	4	2	3	2	4	2	4	4	4	4	4	3	4	5	4	4
A8	4	3	3	3	4	3	4	3	4	2	4	3	3	4	3	4
A9	3	2	3	2	4	4	3	4	5	4	3	3	2	4	4	3

S1	4	3	3	3	5	3	4	3	4	3	4	4	3	5	3	3
S2	3	2	3	2	4	3	3	4	5	3	4	3	2	4	3	5
S3	4	3	3	2	3	3	4	3	4	3	4	4	3	4	4	4
S4	4	2	3	2	4	3	3	4	5	4	4	4	2	4	3	4
S5	3	2	3	3	4	3	4	4	4	3	4	4	2	4	3	4
Mode	4	2	3	2	4	3	4	4	4	3	4	4	2	4	3	4
Median	4	2	3	2	4	3	4	4	4	3	4	4	2	4	3	4
mean	3.7	2.3	3.1	2.3	4	3	3.7	3.5	4.4	3	3.8	3.5	2.5	4.1	3.1	3.9

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